Nathan Schunk

PhD Student – Forestry & Environmental Resources

North Carolina State University

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Research Interests

Integrated assessment and land-use modeling; phosphorus and nutrient systems; land–water–food nexus; global-to-regional scenario analysis; environmental policy under resource constraints; system dynamics.

Education

PhD in Forestry and Environmental Resources (Minor: Economics)
North Carolina State University, Expected 2026
Dissertation: *Global-to-Regional Modeling of Phosphorus Dynamics, Fertilizer Supply Shocks, and Water Quality Impacts*

M.S. in Quantitative Economics and Econometrics — East Carolina University, 2023

B.S. in Economics, Magna Cum Laude — East Carolina University, 2022

Research Experience

Research Scholar — STEPS Center/Baker Resource Economics and Sustainability Lab (RES-Lab), North Carolina State University 2023–Present

- Develop scenario-based and system dynamics models linking land use, nutrient constraints, and environmental outcomes.
- Conduct global-to-regional analyses of phosphorus supply shocks and agricultural responses.
- Contributed to scenario analysis linking economic drivers, land use, and regional water-quality outcomes.

Graduate Research Assistant — Center for Natural Hazards Research (CNHR), East Carolina University 2022–2023

- Designed stakeholder-informed system dynamics models of inland flooding and compound hazard impacts.
- Worked across multiple federally funded projects including NASA, NOAA, and NSF.

Teaching & Academic Support

Teaching Assistant (Intermediate Macroeconomics; Global Economics—Honors), ECU 2022–2023
Economics Tutor (Microeconomics, Macroeconomics, Mathematical Economics), Pirate Academic Success Center 2022-2023

Modeling & Technical Skills

Modeling: Integrated assessment modeling, scenario analysis, system dynamics, global-to-regional downscaling

Programming: R (advanced), GIS (ArcGIS / QGIS / GRASS), Python (working), GAMS (working), SAS, SQL

Data & Methods: FAOSTAT, nutrient budgets, land-use data, sensitivity and uncertainty analysis

Publications & Working Papers

Peer-Reviewed

Baker, J. S., Schunk, N., Scholz, M., Merck, A., Muenich, R. L., Westerhoff, P., Elser, J. J., Duckworth, O. W., Gatiboni, L., Islam, M., Marshall, A.-M., Sozzani, R., & Mayer, B. K. (2024). Global-to-local dependencies in phosphorus mass flows and markets: Pathways to improving system resiliency in response to exogenous shocks. *Environmental Science & Technology Letters, 11* (6), 493–502. https://doi.org/10.1021/acs.estlett.4c00208

In Progress

Cho, C., Schunk, N., Brown, Z. S., Sohngen, B., & Baker, J. S. (2025). *Optimal phosphorus management in a transboundary setting: A dynamic game approach* [Working Paper]

Gong, Z., Wade, C., Cho, C., Schunk, N., Baker, J.S. (2025). Global Land-Use and Market Responses to Fertilizer Price and Quantity Policies: Insights from the GLOBIOM Model.

Schunk, N., Ghosh, R., Baker, J.S. (2026). *A Dynamic Global-to-Regional Phosphorus Modeling Platform: Architecture and Scenario Design*

Schunk, N., Ghosh, R., Baker, J.S. (2026). *Integrated Nutrient Forecasting and Phosphorus Dynamics for the Lake Erie Basin*

Schunk, N., Raff, Z., Baker, J.S (2026). *From Land Use to Water Quality: Nutrient Pollution and Welfare Impacts in the Neuse River Estuary*

Conferences

Global Sustainable Phosphorus Summit (SPS8), 2025 — Lightning talk, poster, panel (Accra, Ghana)
Southern Forest Resource Assessment Consortium (SOFAC) Annual Meeting, 2024, 2025 — Poster (Raleigh, NC)
Natural Hazards Research and Applications Workshop, 2022, 2023 — Poster (Boulder, CO)
International System Dynamics Conference, 2022 (Virtual)

Award

Global Change Research Fellowship — Southeast Climate Adaptation Science Center, 2023

Annual Hazards and Disasters Student Paper Competition — Natural Hazards Center, 2022